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CONTINUOUS IMPROVEMENT IN PORT ORGANIZATION THROUGH KAIZEN MANAGEMENT AND PROCESS APPROACH

Andreea-Maria Moldoveanu[1]
[1] National University of Science and Technology POLITEHNICA Bucharest, Romania,
Corresponding author, ORCID No. 0009-0005-6326-282X, andreea.ungureanu1397@gmail.com

ABSTRACT: Kaizen management has its origins in Japanese best management practices and is dedicated to improving productivity, efficiency, quality and, in general, business excellence. Kaizen methods are internationally recognized as methods for continuously improving, through small steps, the economic results of organizations. The process-based approach is one of the 7 principles of quality management. The process-based approach integrates processes into a complete system to achieve strategic and operational objectives, and risk-based thinking ensures that risk is taken into account when establishing, implementing and maintaining a management system, each process and each activity. Kaizen is the successor to process-based thinking, as processes need to be improved first in order to improve results later. Although Kaizen is approached worldwide, it is rarely discussed in the professional field. This paper aims to address Gemba Kaizen and the five golden rules of Kaizen management adapted to the operational processes in a port organization and the 8-step Kaizen Procedure correlated with the Deming Cycle in the port organization.
KEYWORDS: Port organization, Gemba Kaizen, process approach, Deming cycle, continuous improvement

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1. INTRODUCTION

Kaizen management has its origins in Japanese best management practices and is dedicated to improving productivity, efficiency, quality and, in general, business excellence. Kaizen methods are internationally recognized as methods for continuously improving, through small steps, the economic results of organizations. Small improvements applied to key processes will generate major multiplication of the organization's profit, while being a sure way to obtain customer loyalty/fidelity. Kaizen management represents a solid, strategic tool for achieving and exceeding the organization's objectives [1].

The intention of improvement models such as total quality management, Six Sigma and Plan – Do – Check – Act (PDCA) Cycle is to anticipate difficulties and delays caused by variation in a planned process or the influence of external events. Kaizen is based on defining expected performance, setting goals to achieve expected results, and planning and executing processes that efficiently and effectively achieve those desired results in a predictable and sustainable manner. Kaizen refers to these difficulties and delays as “disruptions” [2].

Processes rarely exist as stand-alone functions. Typically, there are inputs and outputs that depend on other processes. A process-based continuous improvement culture is effective only to the extent that improvements are based on the overall performance of the organization as a system. Improving processes or sub-processes in a vacuum, without understanding their dependence on the input and output value of other processes, is simply a waste of effort. Improving a process without added value is a futile exercise. Thus, Kaizen is the successor of process-based thinking, since first the processes need to be improved in order to then improve the results [3].

Most of the “specifically Japanese” management practices, such as Total Quality Control (TQC), quality control, quality circles and the specific style of employee relations, can be reduced to a single word “Kaizen”. Using this term instead of specialized words such as productivity, total quality control, zero defects, Just-in-time, we can better observe what is happening in the Japanese industry. By following the correct steps and applying the processes effectively, any organization can benefit from practicing Kaizen [4].

There is a practice of managers today that states that their place is in the office. In a port organization of the terminal operator type, this practice is more than harmful. This practice distances them from the real situations on the ground, on the spot (in the gemba). They only come into contact with reality through daily, weekly or monthly reports or meetings. Maintaining direct contact with gemba understanding is the first step in managing a system effectively. Thus, in Masaaki Imai's book [4] we find the five golden rules of gemba management (Figure 1):

- When a problem arises, go to Gemba first

- Check gembutsu (relevant objects)
- Take temporary measures on the spot
- Find the root of the problem
- Standardize to prevent the recurrence of that situation

1. When a problem arises, go to Gemba first
2. Check gembutsu
3. Take temporary measures on the spot
4. Find the root of the problem
5. Standardize to prevent the recurrence
5 Golden Rules of Gemba Management

Figure 1. 5 Golden Rules of Gemba Management

Modern management practices are very much based on the origins of continuous improvement methods and thus we find elements of Kaizen in all modern methods of streamlining activities and improving. Including ISO 9001:2015 has many elements that are directly associated with Kaizen practices such as the PDCA Cycle - process approach, corrections and corrective actions, risk-based thinking, actions to address risks and opportunities.

Gemba represents the place where the action happens, and in a port organization, this place can be the quay, the container storage area, or the loading/unloading area.

2. IMPLEMENTING THE FIVE GOLDEN RULES OF GEMBA MANAGEMENT IN A PORT ORGANIZATION

Implementing the Five Golden Rules of Gemba Management in a port organization involves adapting the essential principles of Gemba management to the specific context of container handling and management operations. Where the problems that arise have a direct impact on the environment – such as increased emissions, high fuel consumption, oil leaks from equipment or polluting spills – applying the Five Golden Rules of Gemba is equally relevant, but with a greater focus on environmental aspects and environmental protection regulations.

2.1 When a problem arises, go to Gemba first

Gemba represents the place where the action happens, and in a port organization like a container terminal this place can be the quay, the container storage area or the loading/unloading area. When an operational problem occurs, the manager or supervisor should go directly on site to observe the problem up close to better understand what is happening. If there are uncontrolled exhaust emissions or oil leaks, managers should arrive quickly to the site to identify the source and limit the impact. Implementation:

- When there is a problem (for example, a delay in unloading containers or a blockage in their storage), managers should immediately travel to the site to observe the situation firsthand.
- By observing the process in action, they will be able to better understand the root causes of the delay or blockage.
- In the event of an oil leak from equipment or an accidental spill of hazardous substances, supervisors and response teams should arrive quickly to the site.
- It is necessary to check the equipment and pollution sources to understand the real impact on the environment (for example, checking oil leaks from forklifts or exhaust emissions from generators).
- It is also necessary to collaborate with environmental protection teams to take immediate measures to limit the effects, such as isolating the affected area or temporarily stopping the faulty equipment.

2.2 Check Gembutsu (relevant objects)

Gembutsu refers to the objects or equipment involved in the operational process. In a container terminal, this can include container handling equipment (reach stackers, forklifts, etc.), port infrastructure (container lifting equipment such as cranes, riders) and even documentation or IT systems that coordinate the flow of containers. In the context of environmental issues, Gembutsu refers to the objects that are directly involved in the environmental aspects. In a container terminal, these could include container handling equipment (which may emit exhaust fumes or leak oil), fuel storage facilities or power generation facilities (which may contribute to pollution). Implementation:

- Check the equipment involved in the problem. For example, if a container cannot be moved on time, ensure that the lifting equipment or forklifts are in good working order.
- If there is a blockage, check that the port infrastructure is well maintained or if there are problems with the technology used to handle the containers.
- Check container handling equipment for any oil or exhaust leaks. For example, forklifts or reach stackers that are not properly maintained can lead to uncontrolled emissions.

- Check fuel storage systems and oil tanks to prevent leaks and soil contamination.
- Examination of port infrastructure to ensure that there are no leaks or accidental spills that could reach the environment.

2.3 Take temporary measures on site

When a problem occurs, it is essential to take quick action to temporarily resolve the situation and prevent further blockages, to minimize the impact on further processes. This step refers to immediate intervention to ensure continuity of operations. In the case of environmental problems, it is essential to take quick action to limit the impact on the environment, even if permanent solutions will come later. These temporary measures should aim to prevent the spread of pollution and reduce risks immediately. Implementation:

- If a lifting equipment is not working, an attempt should be made to allocate another similar equipment to move the container.
- If a blockage occurs due to an incorrect procedure, an ad-hoc solution should be temporarily implemented to free up the area while the problem is analyzed.
- In case of major delays in unloading containers, it may be necessary to redistribute resources to improve the pace of work at that time.
- In the case of uncontrolled exhaust emissions, it may be necessary to temporarily shut down the faulty equipment and redirect traffic or equipment to areas with a lower environmental impact.
- Use emission or leakage capture systems to prevent the spread of pollutants or fuels into the air or onto the ground.

2.4 Find the root cause of the problem

After temporary measures have been implemented and flow has been restored, the root cause of the problem must be understood to prevent its recurrence. This is a critical step in eliminating the root causes and improving processes in the long term. After taking action to limit the immediate impact, the next step is to identify the root cause of the problem that led to the pollution or increased emissions. For example, it could be poor maintenance of equipment, use of poor quality fuels or lack of clear procedures for managing hazardous waste Implementation:

- Conduct a detailed root cause analysis to understand why the problem has occurred. For example, if a piece of equipment is frequently failing, it could be due to poor maintenance or a usage issue.
- Use techniques such as 5 Why analysis or Ishikawa diagram (cause and effect diagram) to discover the root cause of the delay or blockage.
- Examine processes and workflows to identify possible procedural errors, equipment defects or lack of training.
- Analyze the cause of oil leaks or spills. For example, a failure of container handling equipment could be the result of poor maintenance.
- Identify sources of pollutant emissions and understand whether the equipment used does not meet emission standards or is old and inefficient.
- Conducting a detailed process analysis to identify any procedures or equipment that can be improved to reduce pollution risks (e.g., updating technologies or equipment to comply with stricter environmental regulations).

2.5 Standardize to prevent recurrence

Once the root cause of the problem has been identified and corrected, it is important to implement a standard that will prevent its recurrence. Standardization is essential to maintain continuity of improvements and to ensure an efficient and predictable workflow. Implementation:

- Updating operational procedures to reflect lessons learned from the incident.
- Implementing a system for monitoring and reporting the performance of equipment and cargo flow so that any problems can be detected quickly.
- Conducting training sessions for personnel who handle equipment or coordinate cargo flow to ensure compliance with the new standards [5].
- Ensuring that container handling equipment complies with environmental regulations and that all equipment is regularly checked to prevent defects that may lead to environmental impacts.
- Encouraging continuous training of employees on the management of hazardous waste, chemicals and hazardous materials, to avoid accidental pollution.
- Constantly monitoring the environmental performance of the terminal, using technologies to track emissions, fuel consumption, wear and tear, etc.

Therefore, by applying these rules in a structured way, the container terminal can become more efficient and operational problems can be resolved quickly and in the long term. This approach helps to continuously improve processes and reduce the risk of blockages or delays. In terms of the environment, a container terminal can significantly reduce its negative environmental impact and improve the sustainability of its operations. In addition, it will comply with environmental regulations and contribute to creating a safer working environment for employees and the local community.

3. THE 8-STEP KAIZEN PROCEDURE AND THE PDCA CYCLE IN THE PORT ORGANIZATION

Daily activities in the workplace operate according to certain formulas that were initially agreed upon. When written down explicitly, these formulas become standards. Successful daily management boils down to one thing: maintaining and improving standards. This involves not only adhering to current technological, managerial, and operational standards, but also improving current processes to develop new, higher-level standards [4]. Whenever things go wrong in the Gemba and there are scraps or dissatisfied customers, management must identify the root cause, take immediate action to remedy the situation, and change the work procedure to eliminate the problem.

In Kaizen terminology, managers must implement the Standardize – Do - Check - Act (SDCA) cycle (Figure 2).

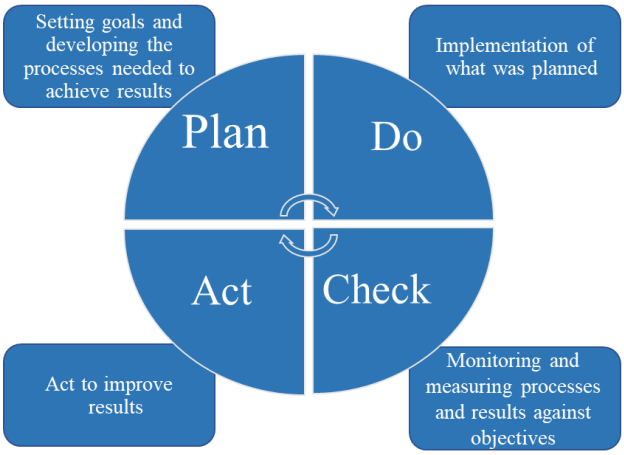

Figure 2. Deming Cycle (PDCA)

When standards are achieved and operators work according to them without deviations, the process is under control. The next step is to take the standards to a higher level. This is based on the Deming Cycle or PDCA cycle. In both cases, the final stage of Acting refers to the standardization and stabilization of the process. Thus, standardization becomes an integral part of everyone's work. Standards in this context represent the best way to ensure quality and the most economical method of working. It is also considered that standards are of two types: managerial and operational. Managerial standards are useful in guiding employees to perform administrative tasks that include: organizational rules, policies, job descriptions, etc. Operational standards concern the way in which employees perform their tasks, so that quality, cost and delivery (QCD) are respected [6].

The word standard in the Kaizen sense represents the adoption by workers of the safest, simplest way of working and the use by the organization of the most efficient and economical method for providing products and services. In current practices, these standards are described more as management, operational, system procedures. According to ISO 9000:2015, the procedure represents a specified way of carrying out an activity or a process [7].

The Kaizen procedure (Figure 3) is a standardized format that has the role of monitoring Kaizen activities carried out in small groups. The same format is used to report Kaizen activities carried out by managers and administrative staff.

1. Choosing a project
2. Analyzing the situation and setting goals
3. Identifying the root cause
4. Establishing solutions
5. Implementing measures
6. Evaluating results and collecting feedback
7. Standardization
8. Process review and continuous improvement
8-step KAIZEN procedure

Figure 3. 8-step Kaizen procedure

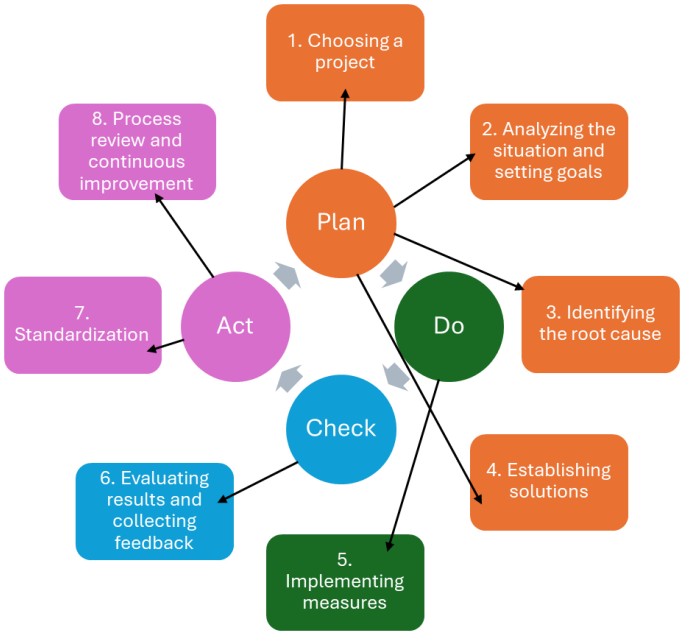

Figure 4. Correlation between the 8-step Kaizen procedure and the PDCA Cycle

The Kaizen procedure follows the Plan – Do – Check – Act cycle. Steps 1-4 refer to the planning stage, step 5 to do, step 6 to check and steps 7 and 8 refer to act (Figure 4).

1. Choosing a project: Select an operational process or project relevant to the organization's objectives, such as reducing emissions or optimizing efficiency. A clear choice allows resources to be directed towards a specific objective. In a container terminal, such a project can lead to a decrease in fuel consumption and associated costs.
2. Analyzing the current situation and setting goals: Evaluate the current process to identify problems and define measurable goals (e.g. reducing emissions by 15% in 6 months). This provides a clear benchmark for the next steps.
3. Identifying the root cause: By analyzing the data and applying the "5 Whys?" method, the main source of the problem is determined. For example, if high emissions are caused by inefficient equipment, the solution should aim to replace or optimize its use.
4. Establishing solutions: Propose measures to eliminate the identified cause, such as purchasing efficient equipment, optimizing routes or implementing green technologies. These actions improve both operational performance and environmental impact.
5. Implementing measures: The solutions established are put into practice, whether by modifying workflows, purchasing new equipment or training staff. Without proper application, improvements remain theoretical.
6. Evaluating results and collecting feedback: Data is analyzed to verify the effectiveness of the implemented measures. If the objectives have been achieved, this translates into reduced costs and emissions. Feedback can indicate new directions for optimization.
7. Standardization: Successful procedures are documented and integrated into standardized practices to ensure that improvements are maintained in the long term and applied uniformly throughout the organization.
8. Process review and continuous improvement: The entire process is periodically reviewed to identify new optimization opportunities, thus maintaining progress and competitive advantage.

Applying the Kaizen procedure in a container terminal, with the aim of reducing emissions and improving operational processes, involves a systematic approach to each step in order to achieve efficient and sustainable results [8].

1. Selecting a project (an operational process).

In this step, a specific operational process is identified that influences the generation of emissions, such as the handling of containers with diesel equipment (forklifts, trucks, etc.) or the loading/unloading process of the ship. The aim is to reduce the CO_2 emissions generated by this equipment by optimizing the processes.

2. Understanding the current situation and setting objectives.

In this step, an assessment of the current emissions in the terminal is carried out. These can be measured as CO_2 emissions per hour or per container handled. The objective could be to reduce emissions, for example, by 15% over a period of 6 months, by improving efficiency and optimizing the equipment used.

3. Data analysis to identify the root cause (Applying the 5 Whys?)

Example: If emissions are high in container handling, questions could be:

- Why is there a lot of CO_2 emissions? Answer: The equipment used is diesel-powered.
- Why is diesel equipment used? Answer: Electric equipment is more expensive and less efficient for certain operations.
- Why is more electric equipment not used? Answer: There is no adequate infrastructure for charging electric equipment.
- Why is there no infrastructure? Answer: Investments in infrastructure have not been a priority.
- Why have they not been a priority? Answer: There is no complete analysis of the long-term benefits in reducing emissions.

Outcome: Identification of the root cause, which may be the use of inefficient equipment or the lack of infrastructure to power equipment with electricity.

4. Establishing countermeasures

- Maneuver optimization: Planning operating routes so that equipment is used as efficiently as possible and reduces idle time.
- Using electric equipment: Replacing diesel equipment with electric equipment where possible.
- Optimizing working times: Reviewing processes to reduce container handling time, using technologies such as automation and digitalization [9].
- Selecting green fuels: Replacing traditional fuels with less polluting ones (e.g. biofuels).

5. Implementing countermeasures

- Replacing a number of diesel equipment with electric or hybrid equipment.
- Installing fast chargers for electric equipment.
- Reconfiguring routes to optimize equipment maneuvering time.
- Training employees to use equipment in a way that minimizes emissions (e.g. avoiding idling or sudden acceleration).

6. Confirm the effect (Analyze results and Collect feedback)

- Measure emissions before and after implementing changes to assess the impact.
- Collect feedback from employees to understand whether the solutions applied were operationally effective.
- Check the information to see if maneuvering time and fuel consumption have decreased.

7. Standardize (Document correction and corrective action)

- Once the emission reduction measures have been successfully implemented, draw up operational procedures to integrate them into daily flows.
- Document the steps and results, and train employees to follow the new standardized procedures.
- Adopt maintenance policies for electrical equipment and charging infrastructure to ensure optimal operation.

8. Re-analyze the process and determine next steps. After a period of implementation, it is necessary to re-analyze the process to identify new opportunities for improvement. New goals can be set based on progress made, such as reducing emissions by another 10% or expanding the use of electrical equipment. Monitoring and control of processes will be necessary to maintain a sustainable and efficient operational flow.

Together with other well-known management practices [10], using international standards and applying the Kaizen procedure together with the PDCA cycle as a port organization, in this case a container terminal operator has the capability to improve both operational efficiency and reduce environmental impact, contributing to the long-term sustainability of its activities.

4. CONCLUSIONS

The integration of Kaizen principles, including the Five Golden Rules of Gemba Management and the PDCA cycle, into port operations demonstrates a systematic approach to continuous improvement, enhancing both operational efficiency and environmental sustainability.

By addressing root causes, standardizing processes, and fostering a culture of continuous optimization, port organizations can reduce emissions, minimize waste, and improve productivity while ensuring compliance with environmental regulations and industry standards.

The successful implementation of Kaizen methodologies in a port organization setting underscores the critical role of structured problem-solving and proactive management in achieving long-term business excellence and sustainable development.

Increased attention to the utility of Japanese management practices adapted to the specifics of ports would bring countless benefits in optimizing processes and continuously improving activity.

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